

## A revision of Japanese spiders of the genus *Dolomedes* (Araneae: Pisauridae) with its phylogeny based on mt-DNA

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**Abstract** — Japanese spiders of the genus *Dolomedes* are revised and its phylogeny is inferred by mt-DNA. *Dolomedes japonicus* Bösenberg & Strand 1906 and *D. angustivirgatus* Kishida 1936 are removed from the synonymy. *Dolomedes fimbriatoides* Bösenberg & Strand 1906 and *D. hinoi* Kayashima 1952 are newly synonymized with *D. sulfureus* L. Koch 1878, and *D. stellatus* Kishida 1936 is synonymized with *D. japonicus*. Two new species, *D. fontus* and *D. silvicola* are described. Relative leg length and proportion of male palpal tibia are considered as good keys to identify *Dolomedes* spiders, whose genital organs closely resemble one another. *Dolomedes sulfureus* and *D. silvicola*, often found on vegetation, have much longer legs and male palpal tibia than their relatives that inhabit near water and run on water surface or hide under water when disturbed. Molecular phylogenetic analysis using mt-COI revealed the following; (((*raptor*, *yawatai*), *japonica*), *orion*), (((*angustivirgatus*, *sulfureus*), *fontus*), (*silvicola*, *saganus*)), *horishanus*).

**Key words** — new species, *Dolomedes fontus*, *Dolomedes silvicola*, new synonymy, leg length, COI, phylogeny

After Koch (1878) described *Dolomedes sulfureus*, twenty species of *Dolomedes* were described from Japan. Of these, nine were synonymized with other species, and one was treated as nomen dubium (Table 1). Thus, ten species have been known as Japanese *Dolomedes* spiders. After examining many specimens from various localities in Japan, we recognized eleven species of the genus *Dolomedes*; nine of them are known species and two are new to science. Furthermore, we verified the previous synonymization by examining the original descriptions and the type specimens. As a result, eight species are reconfirmed to be junior synonyms, two are removed from synonymy, and five are newly synonymized with other species. To verify the validity of species group recognized by morphological resemblance, *raptor*-, *sulfureus*-, *saganus*-, and *horishanus*-group, molecular phylogeny of these spiders was analyzed using the partial sequence of mitochondrial cytochrome oxidase subunit I (mt-COI) gene.

All the specimens examined in this study were collected by Akio Tanikawa unless otherwise noted. The type specimens designated in this paper are deposited in the collection of the department of zoology, National Museum of Nature and Science, Tokyo. Nucleotide sequence data analyzed in this paper are available in the DDBJ/EMBL/GenBank databases.

The abbreviation used in this paper are as follows: ZMH, Zoologisches Institut und Zoologisches Museum der Unive-

rsität Hamburg; MOA, median ocular area; NSMT, National Museum of Nature and Science, Tokyo; SMS, Staatliches Museum für Naturkunde Stuttgart; SMF, Forschungsinstitut und Naturmuseum Senckenberg, Furankfurt am Main.

### Taxonomy

Family Pisauridae

Genus *Dolomedes*

*Dolomedes japonicus* Bösenberg & Strand 1906

[Japanese name: Kikume-hashiri-gumo]

Figs. 1–6

*Dolomedes japonicus* Bösenberg & Strand 1906, p. 313, pl. 13, fig. 312. [syntypes from Saga, Japan, preserved in SMF (1446), examined]; Kishida 1936, p. 124.

*Dolomedes stellatus* Kishida 1936, p. 121, fig. 1 [type specimen from Honshu, Japan, lost]; Paik 1978, p. 371, text-fig. 168, pl. 5, fig. 101, pl. 30, fig. 101; Hu 1984, p. 259, fig. 272; Song, Zhu & Chen 1999, p.347, figs. 203\_A, B; Namkung 2002, p. 347, fig. 21\_2. NEW SYNONYMY

*Type series.* Syntypes, 1♂1juv., Saga, Japan (SMF 4846).

*Other specimens examined.* All the specimens were collected at Orikiawa, Kimitsu-shi, Chiba Pref. 1♀, 17–VII–2005 (NSMT-Ar 7776); 2♀1♂, 8–IV–2006 (2♀, NSMT-Ar 7777, 7778; 1♂, NSMT-Ar 7779); 2♀1♂, 25–IV–2006 (2♀, NSMT-Ar 7780, 7781; 1♂, NSMT-Ar 7782; these spiders

**Table 1.** Species list of the genus *Dolomedes* that have been previously described from Japan.

species	synonymy	Literature	current study
<i>sulfureus</i> L. Koch 1877			reconfirmed
<i>fimbriatoides</i> Bös. & Str. 1906			= <i>sulfureus</i> n. syn.
<i>hercules</i> Bös. & Str. 1906	= <i>sulfureus</i>	Yaginuma 1986	reconfirmed
<i>japonicus</i> (Bös. & Str. 1906)	= <i>sulfureus</i>	Yaginuma 1969	reconfirmed
<i>japonicus</i> Bös. & Str. 1906	= <i>sulfureus</i>	Yaginuma 1986	removed from synonymy
<i>raptor</i> Bös. & Str. 1906			reconfirmed
<i>saganus</i> Bös. & Str. 1906			reconfirmed
<i>pallitarsis</i> Dön. & Str. 1906	= <i>saganus</i>	Zang et al. 2004	reconfirmed
<i>oviger</i> Dön. & Str. 1906	= <i>sulfureus</i>	Kishida 1936	reconfirmed
<i>okinavensis</i> Kishida 1924	nom. dub.	Tanikawa 2003	reconfirmed
<i>angustivirgatus</i> Kishida 1936	= <i>sulfureus</i>	Yaginuma 1986	removed from synonymy
<i>annulatus</i> Kishida 1936	= <i>sulfureus</i>	Paik 1969	reconfirmed
<i>ohsuditiae</i> Kishida 1936	= <i>sulfureus</i>	Yaginuma 1986	reconfirmed
<i>stellatus</i> Kishida 1936			= <i>japonicus</i> n. syn.
<i>horishanus</i> Kishida 1936			reconfirmed
<i>xanthus</i> Saito 1939	= <i>sulfureus</i>	Yaginuma 1972	reconfirmed
<i>hinoi</i> Kayashima 1952			= <i>sulfureus</i> n. syn.
<i>yawatai</i> Ono 2002			reconfirmed
<i>orion</i> Tanikawa 2003			reconfirmed
<i>zatsun</i> Tanikawa 2003			reconfirmed

were collected as juveniles and became adults after rearing); 1♂, 30-IV-2006 (NSMT-Ar 7783).

**Description.** Coloration and markings. Female and male as shown in Figs. 1-2. Carapace dark brown with bright colored markings; longitudinal midline and radial lines diagnostic. Dorsum of abdomen dark brown with light colored markings; black cardiac pattern conspicuous.

**Measurements.** Based on 1♀1♂ from Chiba Pref. (NSMT-Ar 7777, 7783), measurements in parentheses indicate the range among specimens examined. Body ♀27.06 (17.96-27.06), ♂16.21 (14.38-17.84) long. Carapace ♀13.00 (8.70-13.00), ♂8.08 (6.54-9.80) long; ♀11.50 (7.70-11.50), ♂7.42 (5.77-8.80) wide. Length of legs [male/female; tarsus + metatarsus + tibia + patella + femur = total]: I, 5.25 + 9.63 + 10.88 + 5.88 + 11.88 = 43.52/5.70 + 8.90 + 8.70 + 4.00 + 8.90 = 36.20; II, 5.63 + 9.75 + 10.63 + 6.13 + 12.00 = 44.14/5.20 + 8.40 + 8.40 + 4.00 + 9.30 = 35.30; III, 5.13 + 9.50 + 10.13 + 5.50 + 11.50 = 41.76/4.30 + 7.80 + 8.70 + 3.50 + 8.60 = 32.90; IV, 5.88 + 12.38 + 12.00 + 5.63 + 13.19 = 49.08/5.40 + 10.00 + 8.90 + 3.80 + 9.70 = 37.80. Abdomen ♀14.37 (10.13-14.37), ♂8.00 (7.58-9.00) long; ♀9.33 (6.13-9.33), ♂5.33 (5.33-5.50) wide.

Female and male. Carapace longer than wide [length/width ♀1.13 (1.13-1.18), ♂1.09 (1.09-1.13)]. MOA almost as long as wide [length/width ♀1.03 (0.92-1.03), ♂0.96 (0.92-0.96)]; Wider behind than front [anterior width/posterior width ♀0.68 (0.66-0.70), ♂0.67 (0.58-0.67)]. Fang furrow of chelicera with 3 promarginal and 4 retromarginal teeth. Labium almost as long as wide [length/width ♀1.01 (0.94-1.01), ♂1.00 (0.96-1.01)]. Sternum almost as long as wide [length/width ♀1.00 (0.93-1.00), ♂0.98 (0.98-1.01)]. Length of leg I/length of carapace ♀3.35 (3.26-3.43), ♂4.48 (4.12-4.48). Male palp (Figs. 5-6): shapes and arrangement of sclerites as for the *fimbriatus*-group style (Carico 1973). Abdomen longer than wide [length/width ♀1.54 (1.51-1.65), ♂1.50 (1.42-1.64)]. Female genitalia (Figs. 3-4):

shape of epigynum *fimbriatus*-group style (Carico 1973), m-shaped sclerotized part diagnostic (Fig. 3, arrow).

**Remarks.** *Dolomedes japonicus* is related to *D. raptor*, but it can be easily distinguished from the latter even by the coloration and markings. The radial light colored marking on the carapace of *japonicus* is the most diagnostic feature (Figs. 1-2). Such marking is never seen in *raptor* (Fig. 9). As for epigynum, m-shaped sclerotized part is seen only in *japonicus* (Fig. 3, arrow; Fig. 7). The relative length of male palpal tibia is much longer in *japonicus* than in *raptor* (Figs. 5-6, 10-11). The shape of male palpal tibial apophysis is also different from each other (Figs. 6, 11).

**Notes.** *Dolomedes japonicus* Bösenberg & Strand 1906 was synonymized with *D. sulfureus* Koch 1878 by Yaginuma (1986). We examined the syntypes of *D. japonicus* and revealed that they cannot be identified as *D. sulfureus*. On the other hand, the spiders identified as *D. stellatus* Kishida 1936 by the previous authors (see the synonym list above) are identical with them. Consequently, we removed *D. japonicus* from the synonymy of *D. sulfureus* and newly synonymize *D. stellatus* with *D. japonicus*.

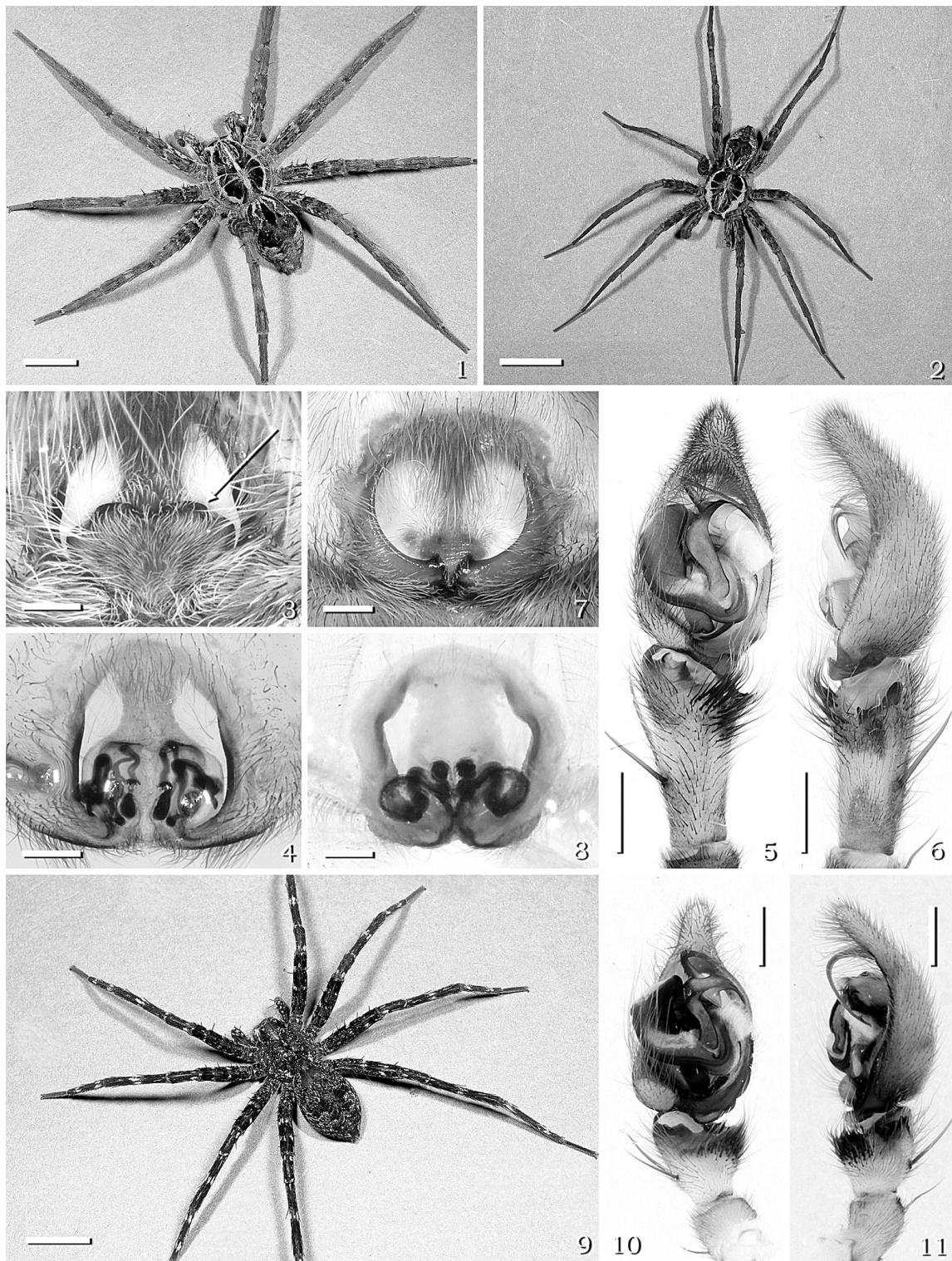
**Distribution.** Japan (Honshu and Kyushu), China, Korea.

#### *Dolomedes raptor* Bösenberg & Strand 1906

[Japanese name: Aoguro-hashiri-gumo]

Figs. 7-11

***Dolomedes raptor* Bösenberg & Strand 1906, p. 309, pl. 8, fig. 119, pl. 13, fig. 342** [syntypes from Saga, Japan, preserved in SMF, not examined]; Yaginuma 1960, p. 80, text-fig. 73, pl. 37, fig. 208; Paik 1978, p. 370, text-fig. 167, pl. 30, fig. 100; Yaginuma 1986, p. 172, text-fig. 95, pl. 46, fig. 3; Chikuni 1989, p. 107, fig. 5; Namkung 2002, p. 348, fig. 21\_3; Tanikawa 2003, p. 38, figs. 14-15; Zhang, Zhu & Song 2004, p. 373, figs. 29-34, 188-193.



**Figs. 1–11.** 1–6, *Dolomedes japonicus* (female: NSMT-Ar 7777, male: NSMT-Ar 7783) — 1, female; 2, male; 3, epigynum; 4, internal genitalia; 5, male palp, ventral view; 6, same, lateral view. 7–11, *Dolomedes raptor* — 7, epigynum; 8, internal genitalia; 9, female; 10, male palp, ventral view; 11, same, lateral view. (Scales: 1, 2, 9, 10 mm; others, 0.5 mm)

*Specimens examined.* AKITA PREF.: 1♀, Funakoshi, Oga, 5-IX-2004, A. Fukushima leg.; 1♀, Kurokawa-okunuma, Shimokitate, Akita-shi, 13-IV-2003, A. Fukushima leg.; 1♀, Shimokitate, Akita-shi, 26-VI-2005, A.

Fukushima leg.; 1♂, Onikubi, Yuzawa-shi, 6-VI-2000, A. Fukushima leg.; FUKUSHIMA PREF.: 1♀, Aizu, X-1985; TOKYO: 1♀, Hachiōji-jōshi, Hachiōji-shi, 21-V-1989; 1♂, same locality, 21-V-1989; CHIBA PREF., 1♀, Orikisawa,

Kimitsu-shi, 28–VII–2005 (juvenile, became adult on July 2006); KANAGAWA PREF.: 1♀, Ōkura, Tanzawa, 21–II–1988 (juvenile, became adult at 22–VII–1988), 1♂, Fudakake, Tanzawa, 17–VI–1990; HYOGO PREF.: 1♂, Ōginosen, Mikata-gun, 22–VI–1972, H. Tanaka leg.

**Remarks.** *Dolomedes raptor* resembles *D. yawatai* and *D. orion*. As for the discriminating point among these species, see Tanikawa (2003). *Dolomedes raptor* can be easily distinguished from *D. japonicus* as mentioned in the remarks of the latter species.

**Distribution.** Japan (Hokkaido, Honshu, Shikoku, Kyushu, Yakushima Is.), China, Korea.

*Dolomedes yawatai* Ono 2002  
[Ishigaki-aoguro-hashiri-gumo]

*Dolomedes yawatai* Ono 2002, p.55, figs. 12–17 [female holotype from Ishigakijima Is., Japan, preserved in NSMT (Ar 5196), not examined]; Tanikawa 2003, p.38, figs. 12–13.

**Additional specimens examined.** OKINAWA PREF., Yonagunijima Is.: 1♀, Kuburadake, 23–VI–2004; 1♀, Angaimiduchi, 21–VI–2004.

**Remarks.** As for the discriminating point among *D. raptor*, *yawatai*, and *orion*, see Tanikawa (2003).

**Distribution.** Japan (Ishigakijima Is., Iriomotejima Is. and Yonagunijima Is.)

*Dolomedes orion* Tanikawa 2003  
[Japanese name: Ō-hashiri-gumo]

*Dolomedes orion* Tanikawa 2003, p. 35, figs. 1–11 [female holotype from Okinawajima Is., Japan, preserved in NSMT (Ar 5306), examined].

**Additional specimens examined.** KAGOSHIMA PREF.: 1♂, Nakanoshima Is., Toshima-mura, 5–VII–2006; 1♀1♂, Yaesao, Tokunoshima Is., 11–IX–2005; OKINAWA PREF.: 1♀1♂, Yamazato, Kumejima Is., 15–VI–2005.

**Remarks.** As for the discriminating point among *D. raptor*, *yawatai*, and *orion*, see Tanikawa 2003.

**Distribution.** Japan (Nakanoshima Is., Amami-ōshima Is., Tokunoshima Is., Okinawajima Is., Tokashikijima Is., and Kumejima Is.)

*Dolomedes fontus* new species  
[Japanese name: Baba-hashiri-gumo]  
(Figs. 12–13, 19–22, 31–33)

**Type series.** All of the following specimens were collected by Y. G. Baba. Holotype ♀, Ōtadai, Ōtaki-machi, Isumi-gun, Chiba Pref., 30–IV–2004 (NSMT-Ar 7784). Paratypes. Tsutsumori, Ōtaki-machi, Isumi-gun, Chiba Pref., 1♀, 5–V–2003 (NSMT-Ar 7785); 4♀4♂, 5–V–2003 (3♀, NSMT-Ar 7786, 7787, 7788; 4♂, 7789, 7790, 7791, 7792; collected as eggs, became adults after rearing); 1♂,

30–IV–2006 (NSMT-Ar 7793; collected as a juvenile, became adult after rearing).

**Description.** Coloration and markings. Female and male (Figs. 12–13). Dark brown, lateral part and cardiac pattern whitish, with several pairs of small white spots on dorsum of abdomen.

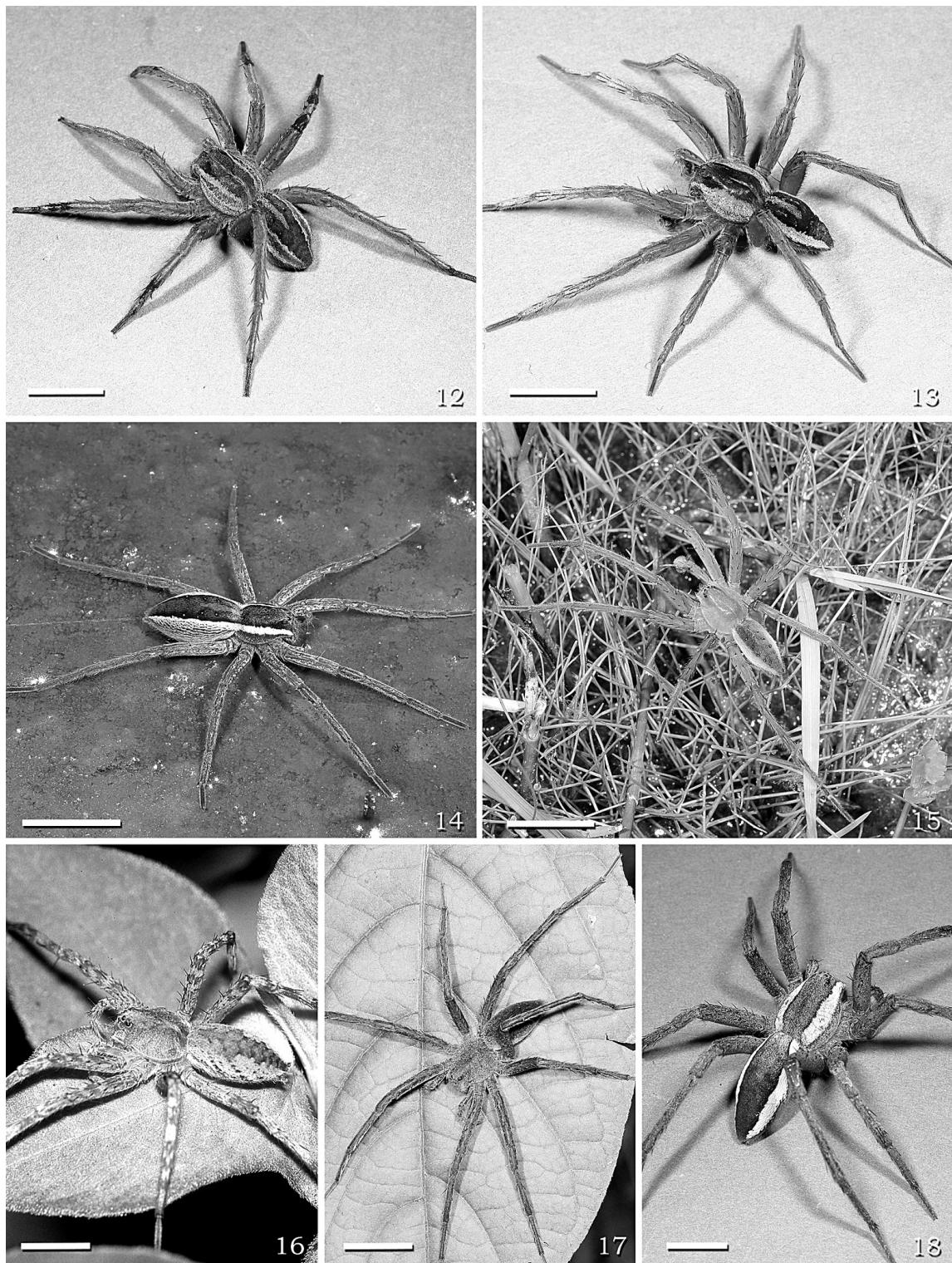
**Measurements.** Based on holotype ♀ and paratype 1♂ (NSMT-Ar 7784, 7793), measurements in parentheses indicate the range among type series. Body ♀19.12 (15.78–20.98), ♂15.89 (15.04–15.90) long. Carapace ♀9.10 (7.58–9.60), ♂7.92 (7.62–8.00) long; ♀7.40 (6.42–8.20), ♂6.67 (6.62–6.90) wide. Length of legs [male/female; tarsus + metatarsus + tibia + patella + femur = total]: I, 3.08 + 4.92 + 8.85 + 3.85 + 7.15 = 24.85/3.62 + 5.62 + 6.15 + 3.77 + 7.38 = 26.54; II, 3.08 + 4.85 + 5.77 + 4.00 + 7.54 = 25.24/3.62 + 5.31 + 5.77 + 3.54 + 7.38 = 25.62; III, 2.92 + 5.00 + 5.15 + 3.85 + 7.00 = 23.92/3.38 + 5.08 + 5.23 + 2.85 + 6.46 = 23.00; IV, 3.69 + 7.46 + 7.08 + 4.00 + 8.23 = 30.46/4.23 + 7.38 + 6.85 + 3.38 + 7.54 = 29.38. Abdomen ♀9.10 (7.25–10.38), ♂8.00 (6.64–8.00) long; ♀6.00 (4.67–7.13), ♂4.60 (4.29–5.00) wide.

Female and male. Carapace longer than wide [length/width ♀1.23 (1.17–1.23), ♂1.19 (1.15–1.19)]. MOA almost as long as wide [length/width ♀1.00 (0.93–1.04), ♂1.02 (1.02–1.07)]; Wider behind than front [anterior width/posterior width ♀0.67 (0.67–0.71), ♂0.68 (0.67–0.70)]. Fang furrow of chelicera with 3 (2–3) promarginal and 4 (3–4) retromarginal teeth. Labium slightly wider than long [length/width ♀0.95 (0.85–0.95), ♂0.96 (0.86–0.96)]. Sternum slightly wider than long [length/width ♀0.96 (0.89–0.96), ♂0.90 (0.90–0.97)]. Length of leg I/length of carapace ♀2.73 (2.73–2.92), ♂3.35 (3.34–3.47). Male palp (Figs. 19–22): shapes and arrangement of sclerites as for the *fimbriatus*-group style (Carico 1973). Abdomen longer than wide [length/width ♀1.52 (1.38–1.57), ♂1.74 (1.43–1.74)]. Female genitalia (Figs. 31–33): shape of epigynum *fimbriatus*-group style (Carico 1973).

**Remarks.** *Dolomedes fontus* resembles *D. angstivirgatus* and *D. sulfureus*. Even in a general appearance, *fontus* can be distinguished from the latter species (Figs. 12–18). Although much color variation is found in *sulfureus* (Fig. 16–18), the coloration like *fontus* is not found. *Dolomedes fontus* can be separated from the latter species by the relative length of the first leg and the male palpal tibia as shown in Table 2 and Figs. 19–30, 40. The first leg and male palpal tibia of *fontus* (Figs. 19–22, 40) are conspicuously shorter than those of *angstivirgatus* (Figs. 23–26, 40) and *sulfureus* (Figs. 27–30, 40). *Dolomedes fontus* and *angstivirgatus*, whose legs are relatively short, inhabit wetlands such as paddy fields. When disturbed, they often run on water surface (Fig. 14). In contrast, *sulfureus*, whose legs are long, inhabits among vegetation (Figs. 16–17) and do not run on water surface when disturbed.

**Distribution.** Japan (Honshu, known only from central part of Bōsō Peninsula).

**Etymology.** The specific name derived from its habitat,



Figs. 12–18. 12–13, *Dolomedes fontus* — 12, female (holotype: NSMT-Ar 7784), 13, male (paratype: NSMT-Ar 7793). 14–15. *Dolomedes angustivirgatus* — 14, female; 15, male. 16–18, *Dolomedes sulfureus*, females. (Scales: 10 mm)

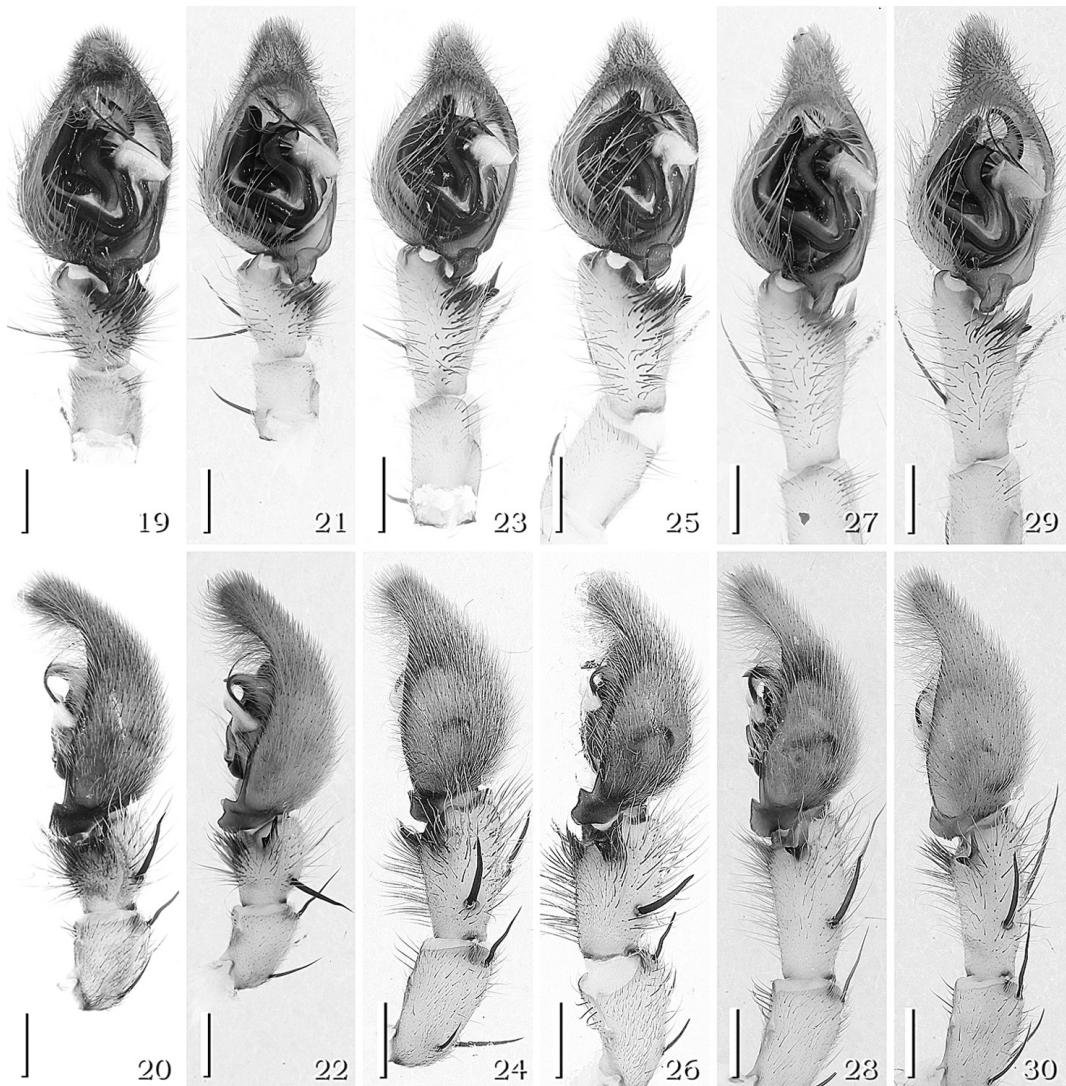
wetland. Fontus is the god of wells and springs in Roman mythology.

**Table 2.** The ratio of the length of leg I to carapace width and the ratio of the length of male palpal tibia to its width in *Dolomedes fontus*, *angustivirgatus* and *sulfureus*.

species	leg I						male palpal tibia		
	female			male					
	N	range	mean $\pm$ SD	N	range	mean $\pm$ SD	N	range	mean $\pm$ SD
<i>fontus</i>	6	3.29–3.45	3.34 $\pm$ 0.06	5	3.85–4.01	3.93 $\pm$ 0.07	5	1.67–1.80	1.76 $\pm$ 0.06
<i>angustivirgatus</i>	22	3.79–4.40	4.08 $\pm$ 0.18	12	4.49–5.27	5.04 $\pm$ 0.21	12	2.06–2.41	2.27 $\pm$ 0.11
<i>sulfureus</i>	56	4.30–5.09	4.71 $\pm$ 0.16	15	5.57–6.63	6.16 $\pm$ 0.36	15	2.80–3.14	3.00 $\pm$ 0.02

cf. Fig. 40.

ANOVA  $p < 0.01$  (log-transformed value); Stell-Dwass method multiple comparison  $p < 0.01$



**Figs. 19–30.** Male palp, odd numbers ventral view, even numbers lateral view. — 19–22, *Dolomedes fontus* (19–20, pratypes, NSMT-Ar 7793, 7789); 23–26, *Dolomedes angustivirgatus* (23–24, NSMT-Ar 7798; 25–26, NSMT-Ar 7797); 27–30, *Dolomedes sulfureus* (27–28, NSMT-Ar 7833; 29–30, NSMT-Ar 7812). (Scales: 1 mm)

*Dolomedes angustivirgatus* Kishida 1936  
[Sujiboso-hashiri-gumo]  
Figs. 14–15, 23–26, 34–36

*Dolomedes hercules*: Bösenberg & Strand 1906 p. 310, pl. 13, fig. 361 [in part, one specimen from "yamato" preserved in

ZMH, examined; female holotype in SMS was destroyed during World War II]. [Misidentification.]

*Dolomedes angustivirgatus* Kishida 1936, p. 123, pl. 13, fig. 3 [type specimen, lost]; Paik 1978, p. 367, pl. 29, fig. 98, text-figs. 165\_1–3; Hu 1984, p. 254, figs. 266\_1–2.

*Dolomedes sulfureus*: Namkung 2002, p. 346, fig. 21\_1 [in part, only upper left figure, nec Koch 1878, misidentification].

*Specimens examined.* AKITA PREF.: 1♂, Shimokitate, Akita-shi, 24–VII–2005, A. Fukushima leg.; 1♀, Kokera-yachi, Akita-shi, 26–VIII–1976, A. Fukushima leg. 1♂, Yurihonjō-shi, 7–X–1999, A. Fukushima leg. IBARAKI PREF., 1♂, Tsukuba-shi, 6–VIII–1976; CHIBA PREF.: 4♀ 1♂, Yokoze, Ōtaki-machi, Isumi-gun, 8–VI–2006 (3♀ 1♂, NSMT-Ar 7794, 7795, 7796, 7797); Kiwadahata, Kimitsu-shi, 1♀, 3–IV–2006 (collected as a juvenile, became adult after rearing), 1♀ 1♂, 8–VI–2006 (1♂, NSMT-Ar 7798). KANAGAWA PREF.: 1♀, Maioka-chō, Totsuka-ku, Yokohama-shi, 15–VI–1985; Noba-chō, Konan-ku, Yokohama-shi, 1♀, 25–VIII–1980, 1♀, 1985 (NSMT-Ar 7799). AICHI PREF.: 1♀ 1♂, Kutsukake-chō, Toyoake-shi, 19–VI–2007, K. Ogata leg. 1♀, Higashiura-chō, Chita-gun, 15–VI–2007, H. Takeuchi leg. OSAKA PREF.; 2♀ 2♂, Gakuen-chō, Naka-ku, Sakai-shi, 18–VI–1976, H. Tanaka leg. (1♂, NSMT-Ar 7800). 1♂, Ōmachi, Kishiwada-shi, 25VI1978, Y. Nishikawa leg. (NSMT-Ar 7801); 1♂, Jinguji, Yao-shi, 2–VII–2007, Y. Ikeda leg. SHIMANE PREF.: 2♀, a mouth of Ōhashi Riv., Matsue-shi, 26–VI–2006, N. Tsurusaki leg.; 1♀ 1♂, Isotake, Ōda-shi, A. Yawata leg. (NSMT-Ar 7802, 7803). TOKUSHIMA PREF., 1♀, I-shima Is., Anan-shi, 19–IX–2005, I. Uematsu leg. FUKUOKA PREF.: 1♂, Motohama, Nishi-ku, Fukuoka-shi, 4–VIII–2007, Y. Eshima leg.

*Description.* Coloration and markings. Female and male (Figs. 14–15). Dark brown, with a longitudinal white lateral band. Abdomen with several pairs of small white spots on dorsum.

*Measurements.* Based on 1♀ 1♂ from Chiba Pref., Japan (NSMT-Ar 7794, 7797), measurements in parentheses indicate the range among specimens examined. Body ♀ 18.76 (12.63–19.83), ♂ 15.09 (12.50–16.96) long. Carapace ♀ 8.33 (5.82–8.70), ♂ 7.46 (5.87–7.92) long; ♀ 6.75 (4.76–8.50), ♂ 6.23 (5.00–6.67) wide. Length of legs [male/female; tarsus + metatarsus + tibia + patella + femur = total]: I, 3.45 + 5.50 + 6.70 + 4.00 + 7.90 = 27.55/4.35 + 6.70 + 7.40 + 4.00 + 8.30 = 30.75; II, 4.30 + 6.65 + 7.75 + 4.80 + 9.70 = 33.20/4.20 + 6.25 + 6.65 + 3.90 + 8.25 = 29.25; III, 3.80 + 6.35 + 7.10 + 4.30 + 9.00 = 30.55/3.20 + 5.50 + 5.60 + 3.20 + 7.20 = 24.70; IV, 4.80 + 9.40 + 9.80 + 4.60 + 10.90 = 39.50/4.40 + 7.80 + 7.60 + 3.65 + 8.60 = 32.05. Abdomen ♀ 9.75 (7.50–12.13), ♂ 7.67 (6.60–9.00) long; ♀ 5.13 (3.25–7.00), ♂ 4.17 (3.40–4.60) wide.

Female and male. Carapace longer than wide [length/width ♀ 1.23 (1.02–1.23), ♂ 1.20 (1.15–1.20)]. MOA wider than long [length/width ♀ 0.90 (0.86–0.91), ♂ 0.93 (0.90–0.93)]; wider behind than front [anterior width/posterior width ♀ 0.64 (0.59–0.64), ♂ 0.60 (0.59–0.63)]. Fang furrow of chelicera with 3 (2–3) promarginal and 4 retromarginal teeth. Labium almost as long as wide [length/width ♀ 0.90 (0.89–1.00), ♂ 0.91 (0.91–1.02)]. Sternum almost as long as wide [length/width ♀ 1.00 (0.94–1.01), ♂ 1.04 (1.00–1.06)]. Length of leg I/length of carapace ♀ 3.31 (3.24–3.60), ♂ 4.12 (4.12–4.45). Male palp (Figs. 23–26): shapes and arrangement of sclerites as for the *fimbriatus*-group style (Carico

1973). Abdomen longer than wide [length/width ♀ 1.90 (1.71–2.31), ♂ 1.84 (1.84–2.09)]. Female genitalia (Figs. 34–36): shape of epigynum *fimbriatus*-group style (Carico 1973).

*Remarks.* *Dolomedes angustivirgatus* closely resembles *D. sulfureus*, but it can be separated from the latter by the following features. On dorsum of abdomen, *angustivirgatus* has several pairs of small white spots (Figs. 14–15), but *sulfureus* does not have such white spots (Figs. 16–18). The first leg of *angustivirgatus* is shorter than that of *sulfureus* (Table 2, Fig. 40). Male palpal tibia of *angustivirgatus* is shorter than that of *sulfureus* (Table 2, Figs. 23–30). The difference in female epigynum is difficult to recognize, but it is possible for skilled worker to discriminate (Figs. 34–35, 37–38).

*Dolomedes angustivirgatus* also resembles *D. fontus*, but can be separated from each other by the following features. The length of leg I and male palpal tibia are longer in *angustivirgatus* than in *fontus* (Table 2, Figs. 19–26, 40). These two species can be scarcely distinguished from each other by general appearance (Figs. 12–15) and the shape of epigynum (Figs. 31–32, 34–35).

*Notes.* Although *Dolomedes angustivirgatus* Kishida 1936 was synonymized with *D. sulfureus* Koch 1878 by Yaginuma (1986), it can be separated from the latter as mentioned above. Consequently we remove it from the synonymy.

*Distribution.* Japan (Honshu, Shikoku, Kyushu), China, Korea.

*Dolomedes sulfureus* L. Koch 1878

[Japanese name: Iouiro-hashiri-gumo]

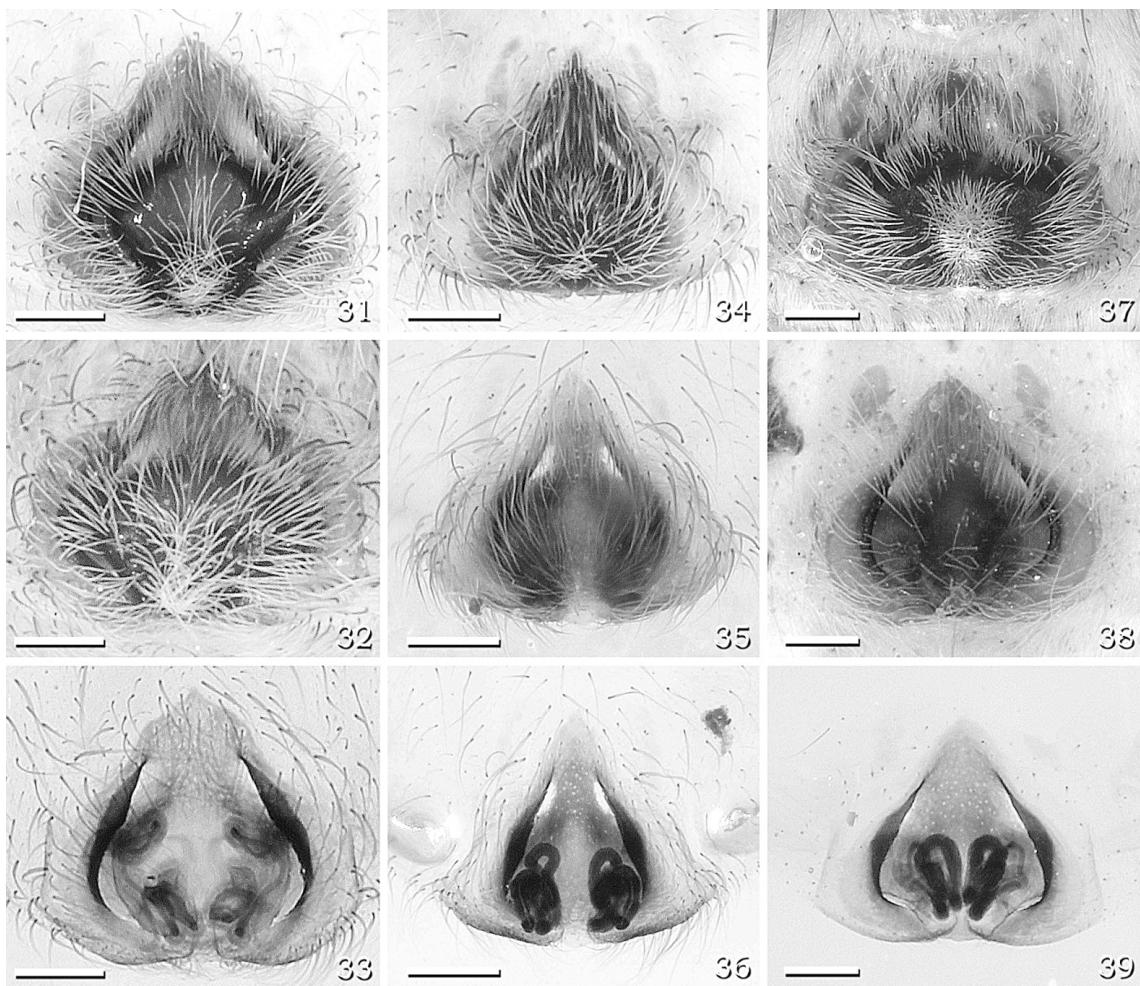
Figs. 16–18, 27–30, 37–39

*Dolomedes sulfureus* L. Koch 1878, p.778 [juvenile holotype from Japan, preserved in Naturhistorisches Museum, Wien, not examined]; Bösenberg & Strand 1906, p.311, pl. 13, fig. 330; Saito 1934, p.349, pl. 15, fig. 80; Kishida, 1936 p.118; Saito 1939, p. 69, fig. 8; Saito 1959, p. 45, pls. 3–4, figs. 21\_a–e; Yaginuma 1960 p. 80, fig. 73\_1–2; Paik 1978, p. 373, figs. 169\_1–5; Hu 1984, p. 258, fig. 270–2; Yaginuma 1986, p. 170, pl. 46, fig. 1, text-fig. 95\_1; Chikuni 1989, p. 107, fig. 6; Song, Zhu & Chen 1999 p. 347, figs. 203C, K. Namkung 2002, p. 346, figs. 21\_1a–b [in part, except upper left fig.]; Zhang, Zhu & Song 2004, p. 378, figs. 55–61, 194–199.

*Caripeta japonica* Bösenberg & Strand 1906, p. 307, pl. 13, fig. 343 [juvenile holotype from Saga, Japan, preserved in SMF (4840), examined].

*Dolomedes fimbriatoides* Bösenberg & Strand 1906, p. 308, pl. 13, fig. 341; Saito 1959, p. 46, figs. 23\_a–c [juvenile holotype from Saga, Japan, preserved in SMF (4845), examined]. NEW SYNONYMY

*Dolomedes hercules* Bösenberg & Strand 1906 p. 310, pl. 13, fig. 361 [in part, 3 specimens from “yamato”, “Setsu”, and “Kasugayama” preserved in ZMH, examined; female holotype in SMS was destroyed during World War II]; Saito 1939, p. 67; Saito 1959, p. 47, figs. 25\_a–c; Yaginuma 1960, p. 80, fig.



**Figs. 31–39.** Female genital organ. 33, 36, 39, dorsal view; others, ventral view. — 31–33, *Dolomedes fontus* (31, paratype, NSMT-Ar 7788; 32–33, holotype, NSMT-Ar 7784). 34–36, *Dolomedes angustivirgatus* (34, NSMT-Ar 1634; 35–36, NSMT-Ar 1637). 37–39, *Dolomedes sulfureus* (37, NSMT-Ar 7806; 38–39, NSMT-Ar 1609). (Scales: 0.5 mm)

73\_4; Paik 1978, p. 369, fig. 166.

*Dolomedes oviger* Dönitz & Strand, in Bösenberg & Strand 1906, p. 389, pl. 8, fig. 113 [type specimen depository unknown].

*Dolomedes annulatus* Kishida 1936, p. 121, pl. 13, fig. 7 [type specimen from Nagano, Japan, lost].

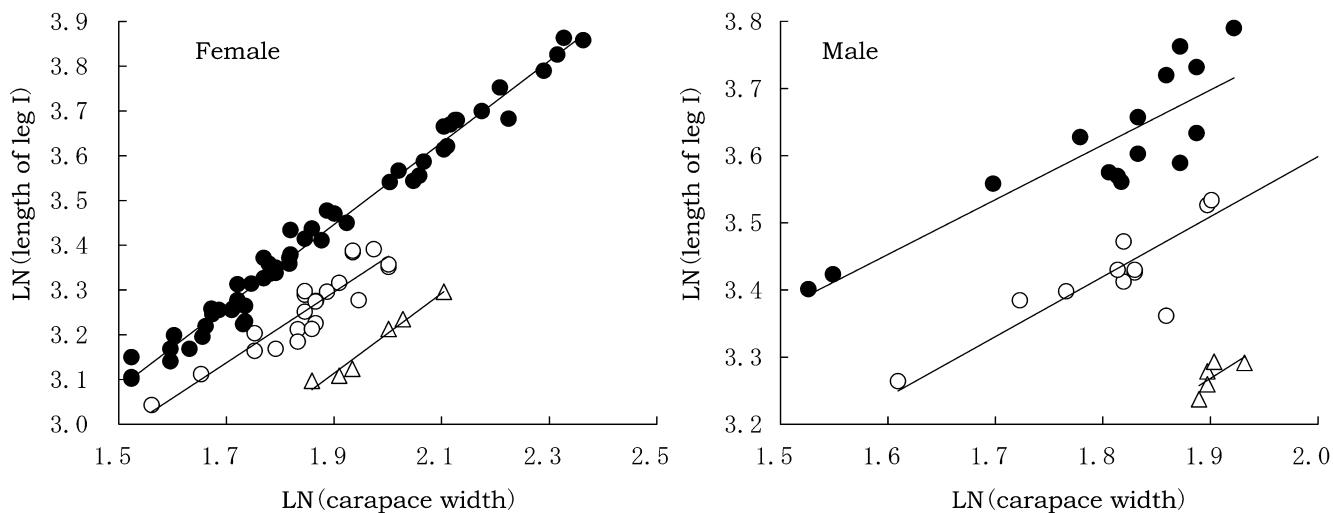
*Dolomedes xanthum* Saito 1939, p. 69, text-fig. 8\_8, pl. 1, fig. 13 [male holotype from Iwate, Japan, preserved in NSMT, not examined]; Saito 1959, p. 46, figs. 22\_a–d.

*Dolomedes hanoi* Kayashima 1952, p. 265, fig. 1 [female holotype from Yamaguchi, Japan, presumably lost]. NEW SYNONYMY

*Dolomedes pallitarsis*: Chikuni 1989, p. 107, Fig. 7 [in part, only male, nec Dönitz & Strand 1906, misidentification].

*Specimens examined.* HOKKAIDO: 1♀, Nishioka, Toyohira-ku, Sapporo-shi, 27–IX–1986, N. Tsurusaki leg.; 1♀, Hokkaido Univ., Sapporo-shi, 18–VIII–1985, N. Tsurusaki leg. AOMORI PREF.: 1♀, Asamushi, Aomori-shi, 12–IX–1978, N. Tsurusaki leg. AKITA PREF.: 1♂,

Nagabashiri, Ōdate-shi, 29–VII–2001, A. Fukushima leg.; 1♀, Tamagawa, Senpoku-shi, 2–VIII–1996, A. Fukushima leg.; Akita-shi, 1♂, 1–VIII–1997, 1♂, 3–VII–1998, A. Fukushima leg.; 1♀, Kagawakata, Akita-shi, 24–VII–2005, A. Fukushima leg.; 1♂, Terauchi, Akita-shi, 25–VII–2004, A. Fukushima leg. (NSMT-Ar 7804); 1♀, Tokusawa, Yurihonjo-shi, 7–X–1999, A. Fukushima leg.; 1♂, Imokawa-ōhashi, Yurihonjo-shi, 7–X–1999, A. Fukushima leg. MIYAGI PREF.: 1♀, Lake Izunuma, Tome-shi, 10–X–1986; YAMAGATA PREF.: 1♀, Soegawa, Iide-chō, 30–VII–1974, A. Fukushima leg. IBARAKI PREF.: 1♀, Tsukuba-shi, 21–IX–1975 (NSMT-Ar 7805). CHIBA PREF.: 1♀, Sanbu-chō, Sanbu-shi, 28–VII–1992; 1♀, Yata, Shiroi-shi, 14–X–2006; R. T. Nakajo leg.; 1♀, Nagaramachi, Chōsei-gun, 7–IX–2006, R. T. Nakajo leg.; 1♀, Ishizuka, Ichihara-shi, 13–IX–2005, R. T. Nakajo leg.; 1♀, Orikisawa, Kimitsu-shi, 27–VII–2006 (NSMT-Ar 7806); 1♀, Nuda, Kimitsu-shi, 31–VII–2006, M. Gomi leg. TOKYO: 6♀, Kudacchi, Izu-ōshima Is., 3–X–1992, M. Hasegawa leg.; KANAGAWA PREF.: Maioka-chō,



**Fig. 40.** Relationship between the carapace width and the leg I length of *Dolomedes sulfureus* (●), *D. angustivirgatus* (○), and *D. fontus* (△). For both female and male, relative leg length differed among three species (ANCOVA  $p < 0.01$ ) and between any pair of species (Steel-Dwass method multiple comparison using adjusted mean  $p < 0.01$ ).

Totsuka-ku, Yokohama-shi, 1♀, 28-VIII-1980; 10♀, 13-IX-1980; 2♀, 4-X-1980; 1♀, 8-IX-1984; 1♀6♂, Noba-chō, Kōnan-ku, Yokohama-shi, 7-IX-1985 (1♀, NSMT-Ar 7807; 1♂, NSMT-Ar 7833, males collected as juveniles, became adult after rearing); 1♀, Anjinzuka, Yokosuka-shi, 15-VIII-1996; 1♀, Tsukui-shiroyama, Sagamihara-shi, 28-IX-2006; Kami-ōshima, Sagamihara-shi, 1♀, 22-IX-2005 (NSMT-Ar 7808), 1♀, 22-IX-2006; 2♀, 28-IX-2006 (1♀, NSMT-Ar 7809); 1♀, Katsusaka, Sagamihara-shi, 31-VIII-2006; 1♀, Tsukimino, Yamato-shi, 24-X-1993; SHIZUOKA PREF.: Shimoda-shi, 1♀, 12-VIII-1981, 1♀, 13-VIII-1981; MIE PREF.: 2♀, Kokubu-chō, Suzuka-shi, 11-VIII-1981, A. Uyemura leg. NARA PREF.: 1♂, Yoshino-chō, Yoshino-gun, 22-VIII-1971, H. Tanaka leg. (NSMT-Ar 7810). TOTTORI PREF.: Misasa-chō, Tōhaku-gun, 1♀, 3-IX-1999, 1♀, 9-IX-1999, N. Tsurusaki leg. HIROSHIMA PREF., Haji Dam, Aki-takada-shi, 1♀, 13-VII-2005, 1♂, 21-VII-2005 (NSMT-Ar 7811), Y. Ihara leg. KAGAWA PREF.: 1♀, Kokubunji-chō, Takamatsu-shi, 3-X-1990; EHIME PREF., 1♂, Omogo-kei, Kamiukena-gun, 16-VII-1970, N. Tsurusaki leg. KUMAMOTO PREF.: 1♂, Jigokubō-son, Aso-mura, 15-VII-1971, H. Tanaka leg.; 1♀, Amakusa-shi, 12-VIII-1999, Y. G. Baba leg. KAGOSHIMA PREF.: 1♂, Yakushima Island, 14-VII-2006 (NSMT-Ar 7812).

**Description.** Coloration and markings. This species has three major color morphs: 1) light brown mottled with dark brown (Fig. 16), 2) uniformly brown (Fig. 17), and 3) dark brown with a pair of lateral white band (Fig. 18).

**Measurements.** Based on 1♀ from Chiba Pref. (NSMT-Ar 7806) and 1♂ from Kanagawa Pref. (NSMT-Ar 7833), measurements in parentheses indicate the range among specimens examined. Body ♀19.85 (12.38–26.06), ♂16.75 (11.88–17.63) long. Carapace ♀10.00 (5.53–12.25), ♂8.30 (5.73–8.33) long; ♀8.20 (4.59–9.88), ♂6.60 (4.60–6.83)

wide. Length of legs [male/female; tarsus + metatarsus + tibia + patella + femur = total]: I,  $5.13 + 8.50 + 9.75 + 5.06 + 10.63 = 39.07/6.60 + 9.10 + 8.90 + 4.15 + 9.10 = 37.85$ ; II,  $5.00 + 8.13 + 9.44 + 4.88 + 11.00 = 38.45/5.60 + 7.90 + 8.10 + 4.10 + 9.20 = 34.90$ ; III,  $4.13 + 7.31 + 8.00 + 4.31 + 9.88 = 33.63/4.30 + 6.80 + 6.55 + 3.40 + 8.00 = 29.05$ ; IV,  $5.25 + 11.13 + 11.25 + 4.75 + 12.38 = 44.76/5.60 + 9.60 + 8.80 + 3.85 + 9.80 = 37.65$ . Abdomen ♀10.88 (6.92–15.56), ♂8.80 (6.31–9.40) long; ♀6.00 (3.00–7.36), ♂3.90 (2.92–4.50) wide.

**Female and male.** Carapace longer than wide [length/width ♀1.22 (1.14–1.24), ♂1.26 (1.20–1.26)]. MOA wider than long [length/width ♀0.95 (0.86–0.95), ♂0.94 (0.90–0.95)]; Wider behind than front [anterior width/posterior width ♀0.62 (0.57–0.65), ♂0.65 (0.56–0.65)]. Fang furrow of chelicera with 3 (2–3) promarginal and 4 (4–5) retro-marginal teeth. Labium almost as long as wide [length/width ♀1.00 (0.94–1.00), ♂1.04 (1.00–1.08)]. Sternum almost as long as wide [length/width ♀0.99 (0.91–0.99), ♂1.01 (0.98–1.01)]. Length of leg I/length of carapace ♀3.91 (3.61–4.04), ♂4.56 (4.56–5.37). Male palp (Figs. 27–30): shapes and arrangement of sclerites as for the *fimbriatus*-group style (Carico 1973). Abdomen longer than wide [length/width ♀1.81 (1.81–2.31), ♂2.26 (2.02–2.26)]. Female genitalia (Figs. 37–39): shape of epigynum *fimbriatus*-group style (Carico 1973).

**Remarks.** The present species resembles *D. fontus* and *D. angustivirgatus*. For the discrimination points among these species, see the remarks of the latter species.

**Notes.** Although the holotype of *Dolomedes fimbriatoides* Bösenberg & Strand 1906 is a juvenile, we determined it as *D. sulfureus* Koch 1878 using the relative length of the first leg. Consequently, *D. fimbriatoides* is newly synonymised here with *D. sulfureus*.

Because we could not find the holotype of *D. hanoi*

Kayashima 1952, we determined it as *D. sulfureus* by the relative length of the first leg calculated from the measurement in the original description, and newly synonymize it with *D. sulfureus*.

**Distribution.** Japan (Hokkaido, Honshu, Shikoku, Kyushu, and Yakushima Is.), China, Korea.

*Dolomedes saganus* Bösenberg & Strand 1906  
[Japanese name: Sujibuto-hashiri-gumo]  
(Figs. 41–42, 45–48, 53–54, 57–59)

*Dolomedes saganus* Bösenberg & Strand 1906, p. 312, pl. 13, fig. 328 (pl. 8, fig. 115 does not agree with syntypes [syntypes 1♀15 juv. from Saga, Japan, preserved in SMF (4851, 4852) and 1♀1juv. from "Hiuga", Japan, preserved in ZMH, examined]; Zhang, Zhu & Song 2004, p. 375, [in part, figs. 38, 40; figs. 39, 41–43, misidentification].

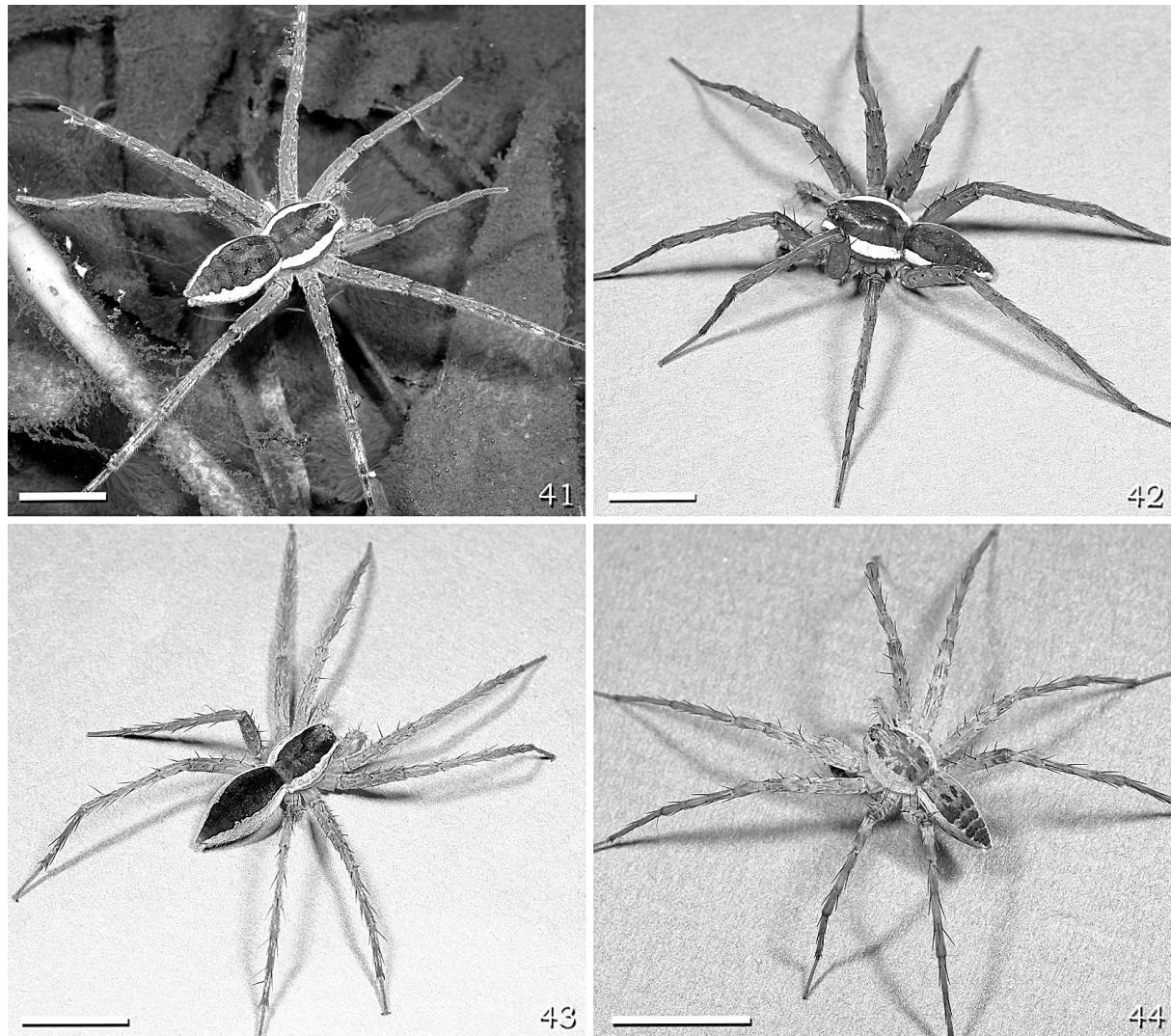
*Dolomedes pallitarsis* Dönnitz & Strand, in Bösenberg & Strand 1906, p. 388, pl. 8, fig. 114 [type specimen depository un-

known]; Yaginuma 1985, p. 124, figs. 4\_A, C; Yaginuma 1986, p. 171, pl. 46, fig. 2, text-fig. 95\_2; Chikuni 1989, p. 107, fig. 7 [in part, female, male misidentification]; Song, Zhu & Chen 1999, p. 347, figs. 13\_D, 202\_O–P, 203\_H–I.

*Dolomedes insurgens* Chamberlin 1924, p. 25, pl. 6, fig. 41; Song, Zhu & Chen 1999, p. 347, figs. 203D–E.

**Type series.** Syntypes. 1♀3juv. (SMF 4851), 12juv. (SMF 4852), Saga, Japan and 1♀1juv. (ZMH), "Nishitake, Hiuga, Kiushu", VII–1898.

**Other specimens examined.** CHIBA PREF.: 5♀5♂, Tsutsumori, Ōtaki-machi, Isumi-gun., 8–IV–2006 (3♀3♂, NSMT-Ar 7813, 7814, 7815, 7816, 7817, 7818, collected as juveniles, became adults after rearing); 1♂, Yokoze, Ōtaki-machi, Isumi-gun, 8–IV–2006 (NSMT-Ar 7819); 3♀2♂, Hiratsuka, Kamogawa-shi, 8–IV–2006 (2♀1♂, NSMT-Ar 7820, 7821, 7822; collected as juvenile, became adults after rearing). KANAGAWA PREF.: Atsugi-shi, 1♀, 15–V–1984; 1♀, 6–VI–1993. HIROSHIMA PREF.: Haji Dam,



**Figs. 41–44.** 41–42, *Dolomedes saganus* — 41, female; 42, male. 43–44, *Dolomedes silvicola* — 43, female; 44, male, color variation, usually as in female. (Scales: 10 mm)

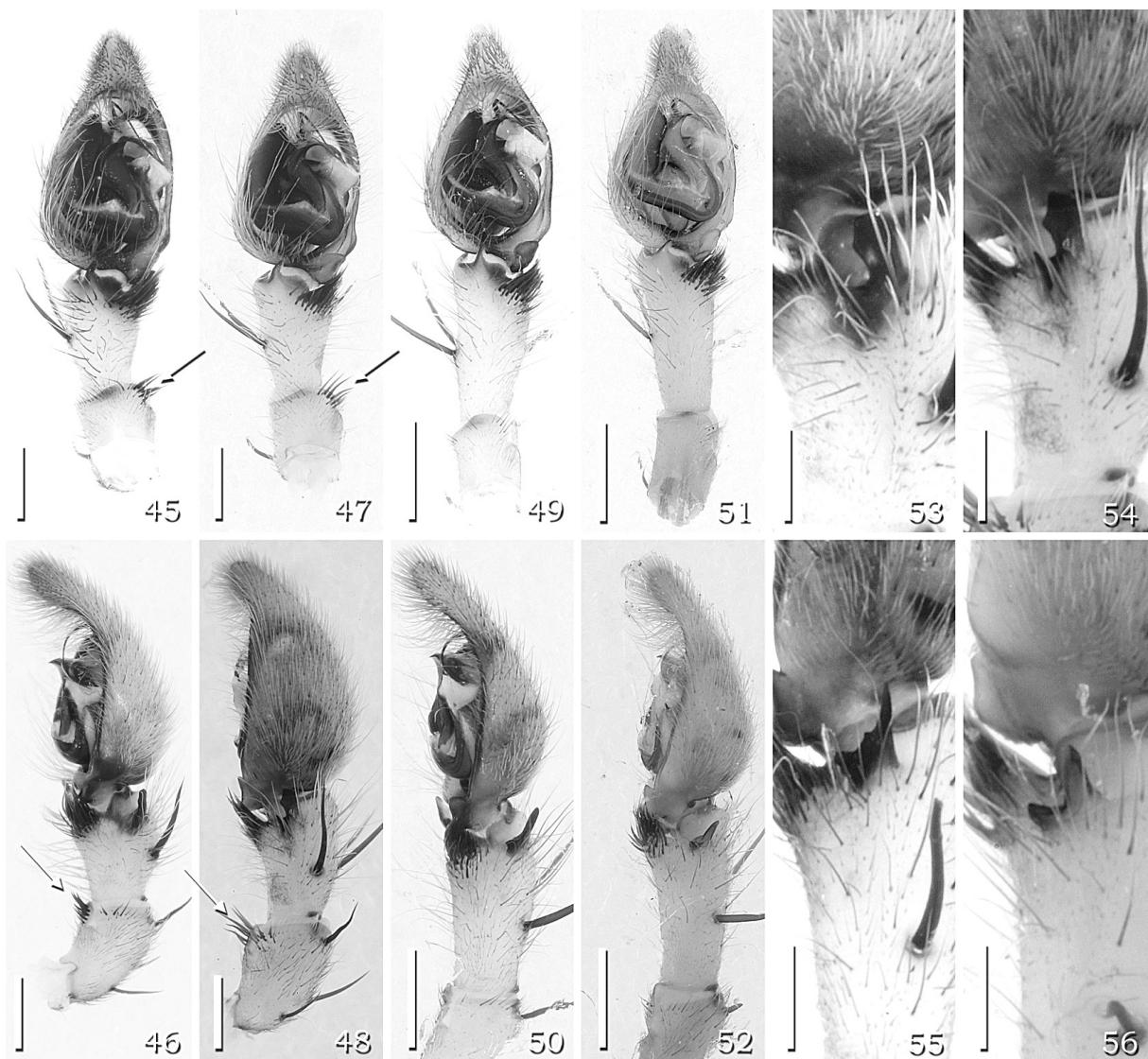
Akitakada-shi, 1♂, 15-V-2005, 1♂, 16-V-2005, 1♂, 15-VII-2005, 1♂, 21-VII-2005 (NSMT-Ar 7823), 1♀, 3-X-2005, Y. Ihara leg.

**Description.** Coloration and markings. Carapace dark green or brownish green, with a pair of longitudinal lateral white band. Abdomen also dark green or brownish green, with longitudinal lateral white band and several pairs of small white spots (Figs. 41–42).

**Measurements.** Based on 1♀1♂ from Chiba Pref. (NSMT-Ar 7813, 7819), measurements in parentheses indicate the range among specimens examined. Body ♀18.55 (13.63–18.55), ♂13.75 (10.13–13.75) long. Carapace ♀8.70 (5.87–9.00), ♂7.31 (4.88–7.31) long; ♀7.40 (5.00–7.90), ♂6.69 (4.35–6.69) wide. Length of legs [male/female; tarsus+metatarsus+tibia+patella+femur=total]: I, 3.70+5.90+6.95+4.10+8.00=28.65/4.15+6.15+6.54+3.69+7.46=27.99; II, 3.70+6.15+6.90+4.10+8.10=28.95/

4.15+6.08+6.38+3.62+7.69=27.92; III, 3.30+6.10+6.40+3.70+7.70=27.20/3.54+5.85+5.77+3.15+7.12=25.43; IV, 4.30+8.20+8.10+4.00+8.90=33.50/4.62+7.69+7.23+3.31+7.92=30.77. Abdomen ♀10.33 (7.75–10.33), ♂6.62 (4.71–6.67) long; ♀5.77 (4.67–5.77), ♂3.54 (2.53–4.20) wide.

Female and male. Carapace longer than wide [length/width ♀1.18 (1.14–1.18), ♂1.09 (1.09–1.14)]. MOA wider than long [length/width ♀0.91 (0.82–0.95), ♂0.88 (0.88–0.93)]; wider behind than front [anterior width/posterior width ♀0.71 (0.64–0.71), ♂0.68 (0.63–0.69)]. Fang furrow of chelicera with 3 promarginal and 4 retromarginal teeth. Labium slightly wider than long [length/width ♀0.92 (0.77–0.94), ♂0.88 (0.82–0.91)]. Sternum almost as long as wide [length/width ♀0.99 (0.89–0.99), ♂0.94 (0.94–1.00)]. Length of leg I/length of carapace ♀3.29 (3.04–3.44), ♂3.83 (3.83–4.41). Male palp (Fig. 45–48, 53–54): shapes and arrange-



**Figs. 45–56.** Male palp; odd numbers from 45 to 51, ventral view; even numbers from 46 to 52 and 53–56, lateral view. — 45–48, *Dolomedes saganus* (45–46, 53, NSMT-Ar 7819; 47–48, 54, NSMT-Ar 7816). 49–52, *Dolomedes silvicola* (paratypes; 49–50, 55, NSMT-Ar 7827; 51–52, 56, NSMT-Ar 7832). (Scales: 45–52, 1 mm; 53–56, 0.5 mm)

ment of sclerites as for the *fimbriatus*-group style (Carico 1973). Abdomen longer than wide [length/width ♀1.79 (1.66–1.79), ♂1.87 (1.59–1.87)]. Female genitalia (Figs. 57–59): shape of epigynum *fimbriatus*-group style (Carico 1973).

**Remarks.** *Dolomedes saganus* resembles *D. silvicola*. For the discriminating points, see the remarks of *silvicola*.

**Notes.** The status of *Dolomedes saganus* Bösenberg & Strand 1906 is much controversial. Although the figure of epigynum in the original description of *saganus* (Bösenberg & Strand 1906, pl. 13, fig. 328) agrees with those of two females in syntypes, but the figure of the general appearance (Bösenberg & Strand 1906, pl. 8, fig. 115) does not agree with any of the syntypes. Furthermore, the original description notes the presence of white spots on dorsum of abdomen, whereas the figure lacks white spots. Meanwhile the original figure of *Dolomedes pallitarsis* Dönnitz & Strand, in Bösenberg & Strand 1906 (pl. 8, fig. 114), whose type specimen was lost, agrees with the syntypes of *saganus* and the description of white spots on abdomen. In addition, the original figure of *saganus* resembles the type specimen of *Dolomedes fimbriatoides* Bösenberg & Strand 1906. Thus there must have been some mistakes when these figures were arranged and numbered. This caused many misidentifications by many authors. The spiders identified as *saganus* by many previous authors do not agree with the syntypes of *saganus*, but the spiders previously identified as *pallitarsis* are identical with them. Zhang, Zhu & Song (2004) considered *Dolomedes pallitarsis* as a junior synonym of *Dolomedes saganus*. Although their decision itself is correct, their *saganus* includes real *saganus* (figs. 38, 40)

and so called *saganus* (figs. 39, 41–43). The latter species is described as a new species below.

**Distribution.** Japan (Hokkaido, Honshu, Shikoku, Kyushu), China.

***Dolomedes silvicola* new species**

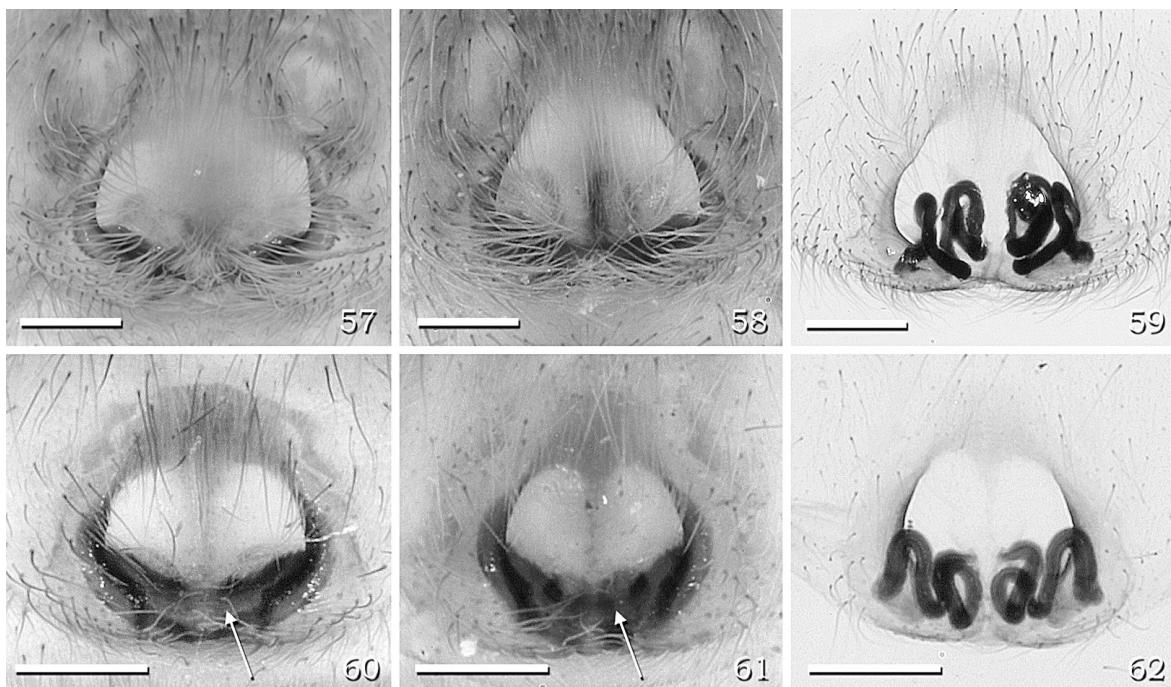
[Japanese name: Sujika-hashiri-gumo]

(Figs. 43–44, 49–52, 55–56, 60–62)

*Dolomedes saganus*: Yaginuma 1960, p. 81, pl. 38, fig. 209, text-fig. 74\_1; Yaginuma 1986, p. 172, pl. 46, fig. 4, text-fig. 95\_4; Chikuni 1989, p. 106, fig. 4; Zhang, Zhu & Song 2004, p. 375 (in part, figs. 39, 41–43). [nec Bösenberg & Strand 1906, misidentification]

**Type series.** Holotype ♀, Orikisawa, Ōtaki-machi, Isumi-gun, Chiba Pref., 27–VII–2006 (NSMT-Ar 7824). Paratypes. AKITA PREF.: 1♀, Yanagisawa, Higashi-naruse-mura, Ogachi-gun, 18–VIII–2002, A. Fukushima leg. (NSMT-Ar 7825). CHIBA PREF.: 1♀, same data as holotype (NSMT-Ar 7826); 3♂, Ishizuka, Ichihara-shi, 2–VIII–2006, M. Gomi & R. T. Nakajo leg. (NSMT-Ar 7827, 7828, 7829). MIE PREF., 1♀, Kokubu-chō, Suzuka-shi, 13–VIII–1981, A. Uyemura leg. (NSMT-Ar 7830). KYOTO PREF.: 1♀, Ashiu, Miyama-chō, Nantan-shi, 10–VIII–1975, H. Yoshimoto leg. (NSMT-Ar 7831). OSAKA PREF.: 1♂, Amami, Kawachinagano-shi, 27–VII–1969, H. Tanaka leg. (NSMT-Ar 7832).

Other specimens examined. HOKKAIDO: 2♀, Kanayama Dam, Minami-furano-chō, Sorachi-gun, 30–VII–1985. CHIBA PREF.: same locality as holotype 1♀, 27–



**Figs. 57–62.** Female genital organ; 57, 58, 60, 61, ventral view; 59, 62, dorsal view. — 57–59, *Dolomedes saganus* (57, NSMT-Ar. 7813; 58–59, NSMT-Ar 7820). 60–62, *Dolomedes silvicola* (60, holotype, NSMT-Ar 7824; 61–62, paratype, NSMT-Ar 7825). (Scales: 0.5 mm)

VII-2006; 1♂, 10-X-2006 (collected as juvenile, became adult after rearing). 1♂, Ishizuka, Ichihara-shi, 2-VIII-2006, M. Gomi & R. T. Nakajo leg. KANAGAWA PREF.: Tsukui-shiroyama, Sagamihara-shi, 1♀, 19-VII-1981, 2♀, 28-IX-2006. WAKAYAMA PREF.: 1♀, Kumanogawa-chō, Shingu-shi, 23-VII-1993.

**Description.** Coloration and markings. Female and male. Carapace and abdomen dark green or brownish green, with a pair of longitudinal lateral white band (Fig. 43). Variation: rarely with light colored radial line on carapace and several transverse lines on abdomen (Fig. 44).

**Measurements.** Based on holotype ♀ and 1♂ from paratype (NSMT-Ar 7824, 7827), measurements in parentheses indicate the range among specimens examined. Body ♀13.88 (10.75–17.59), ♂12.13 (8.85–14.38) long. Carapace ♀6.46 (4.29–7.25), ♂5.47 (4.05–6.69) long; ♀5.46 (3.57–5.75), ♂4.65 (3.57–5.38) wide. Length of legs [male/female; tarsus + metatarsus + tibia + patella + femur = total]: I,  $3.33 + 5.42 + 6.83 + 3.25 + 7.33 = 26.16$ ; II,  $4.62 + 6.69 + 7.23 + 2.92 + 7.08 = 28.54$ ; III,  $3.17 + 5.58 + 6.83 + 3.17 + 7.58 = 26.33$ ; IV,  $4.00 + 6.46 + 6.77 + 2.85 + 7.23 = 27.31$ ; ♂,  $2.83 + 5.17 + 5.75 + 2.75 + 6.83 = 23.33$ ; III,  $3.23 + 5.69 + 5.77 + 2.54 + 6.38 = 23.61$ ; IV,  $3.67 + 7.50 + 7.67 + 3.00 + 7.33 = 29.17$ ; ♂,  $4.15 + 7.54 + 7.23 + 2.65 + 7.62 = 29.19$ . Abdomen ♀7.17 (6.07–9.63), ♂6.69 (4.94–7.67) long; ♀3.75 (3.40–6.25), ♂3.38 (2.28–3.50) wide.

Female and male. Carapace longer than wide [length/width ♀1.18 (1.18–1.26), ♂1.18 (1.13–1.24)]. MOA wider than long [length/width ♀0.91 (0.87–0.92), ♂0.90 (0.90–0.92)]; wider behind than front [anterior width/posterior width ♀0.63 (0.59–0.64), ♂0.64 (0.60–0.64)]. Fang furrow of chelicera with 3 (2–3) promarginal and 4 retromarginal teeth. Labium, ♀ slightly wider than long, ♂ almost as wide as long [length/width ♀0.93 (0.83–0.93), ♂1.02 (0.92–1.02)]. Sternum almost as long as wide [length/width ♀0.98 (0.97–1.03), ♂1.03 (1.03–1.07)]. Length of leg I/length of carapace ♀4.05 (3.83–4.39), ♂5.22 (5.04–5.76). Male palp (Figs. 49–52, 55–56): shapes and arrangement of sclerites as for the *fimbriatus*-group style (Carico 1973). Abdomen longer than wide [length/width ♀1.91 (1.54–1.91), ♂1.98 (1.98–2.19)]. Female genitalia (Figs. 60–62): shape of epigynum *fimbriatus*-group style (Carico 1973).

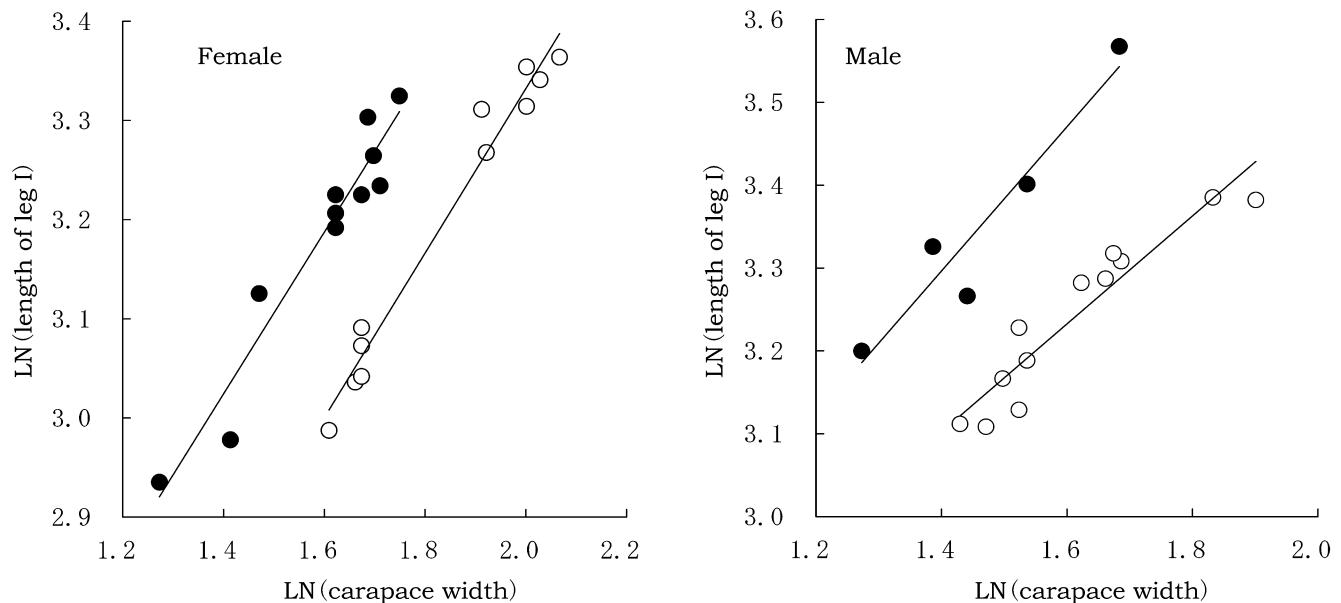
**Remarks.** The present new species, *Dolomedes silvicola*, resembles *D. saganus*, but can be separated from the latter by the following features. *Dolomedes saganus* has several pairs of small white spots on dorsum of abdomen (Figs. 41–42), but *silvicola* does not (Figs. 43–44). Legs and male palpal tibia of *saganus* are shorter than *silvicola* (Table 3, Fig. 63). Male palpal patella anteriorly has several strong bristles in *saganus* (Figs. 45–48, arrows), but not in *silvicola*.

**Table 3.** The ratio of the length of leg I to carapace width and the ratio of the length of male palpal tibia to its width in *Dolomedes saganus* and *silvicola*.

species	leg I						male palpal tibia		
	female		male						
	N	range	mean $\pm$ SD	N	range	mean $\pm$ SD	N	range	mean $\pm$ SD
<i>saganus</i>	12	19.83–28.90	24.64 $\pm$ 3.49	13	21.30–28.08	24.51 $\pm$ 2.38	13	1.86–2.14	2.01 $\pm$ 0.08
<i>silvicola</i>	11	18.83–27.79	24.30 $\pm$ 2.84	5	23.33–33.70	27.40 $\pm$ 4.02	5	2.59–3.07	28.1 $\pm$ 0.18

cf. Fig. 63.

t-test  $p < 0.01$  (log-transformed value)



**Fig. 63.** Relationship between the carapace width and the leg I length of *Dolomedes silvicola* (●) and *D. saganus* (○). ANCOVA  $p < 0.01$ , for both female and male.

(Figs. 49–52). Tibial apophysis of male palp is rather flattened in *saganus* (Figs. 53–54), but more aculeate in *silvicola* (Figs. 55–56). Reddish membranous part is seen at the posterior part of epigynum in *silvicola* (Figs. 60–61, arrow), but not in *saganus* (Figs. 57–58).

**Notes.** As mentioned in the notes of *saganus*, the taxonomic treatment of *saganus* and *silvicola* has been much controversial.

**Distribution.** Japan (Hokkaido, Honshu, Shikoku, Kyushu, Yakushima Is.,), China.

**Etymology.** The specific name derived from its habitat.

*Dolomedes horishanus* Kishida 1936

[Japanese name: Herijiro-hashiri-gumo]

*Dolomedes horishanus* Kishida 1936, p. 119, pl. 13, fig. 9 [type specimen from Taiwan, lost]; Tanikawa 2003, p. 39, figs. 21–26.

**Additional specimens examined.** KAGOSHIMA PREF.: 1juv., Akina, Tatsugo-chō, Amami-ōshima Is., 5–VII–2005, Y. G. Baba leg. OKINAWA PREF.: 1♂, Daruma-yama, Kumejima-chō, Kumejima Is., 8–III–2005, Y. G. Baba leg.; 1♀, Shimoji-chō, Miyakojima-shi, Miyakojima Is., 18–IX–2004, A. Yawata leg.

**Remarks.** This species can be easily distinguished from the other Japanese *Dolomedes* species by the general appearance.

**Notes.** In the previous paper (Tanikawa 2003), Tanikawa considered *Dolomedes mizhoanus* Kishida 1936 as a color variation of *horishanus* and treated it as a junior synonym of

the latter species. While Zhang, Zhu and Song (2004) removed *mizhoanus* from the synonymy. Judging from the figures of *mizhoanus* in their paper, these two species can be separated by the shape of epigynum and the length of male palpal tibia (cf. Tanikawa 2003, figs. 24, 25; Zhang, Zhu & Song 2004, figs. 19, 22).

#### *Dolomedes zatsun* Tanikawa 2003

[Japanese name: Sasaki-hashiri-gumo]

*Dolomedes zatsun* Tanikawa 2003, p. 38, figs. 16–20 [holotype from Okinawajima, Japan, preserved in NSMT (Ar 5310), examined].

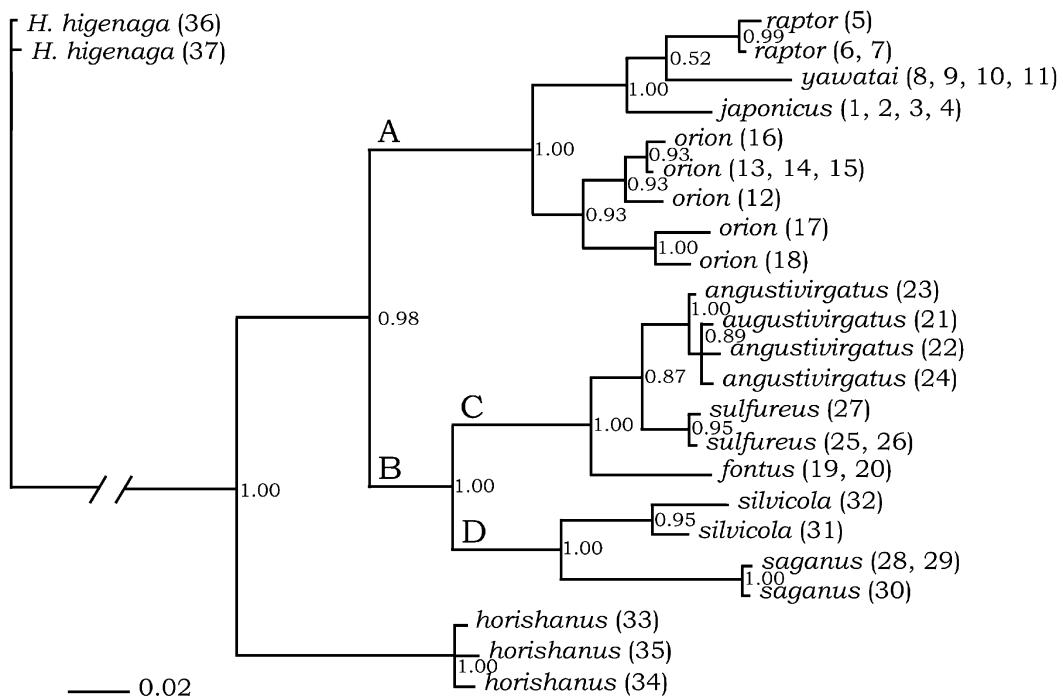
**Remarks.** This species can be easily separated from the other Japanese *Dolomedes* spiders by the general appearance (Tanikawa 2003).

**Notes.** No additional specimen has been available even from the type locality.

#### Phylogeny

**Taxon analysed.** All of the Japanese species, except for *Dolomedes zatsun*, were analysed. The sampling data and accession number of DDBJ/EMBL/GenBank are shown in appendix. *Hygroponda higenaga* (Kishida 1936) was used as an out-group.

**DNA extraction, polymerase chain reaction and sequencing.** Specimens were preserved in 99.5% ethanol, and genomic DNA was extracted from muscle of legs using DNeasy Blood & Tissue kit (Qiagen, Inc.). The mitochondrial cytochrome oxidase I (mt-COI) partial sequence were



**Fig. 64.** 50% majority rule consensus tree topologies obtained from Bayesian inference. Posterior probabilities are shown just after nodes. Numbers in parentheses correspond to the specimen numbers in appendix. Scale: 0.02 substitution/site.

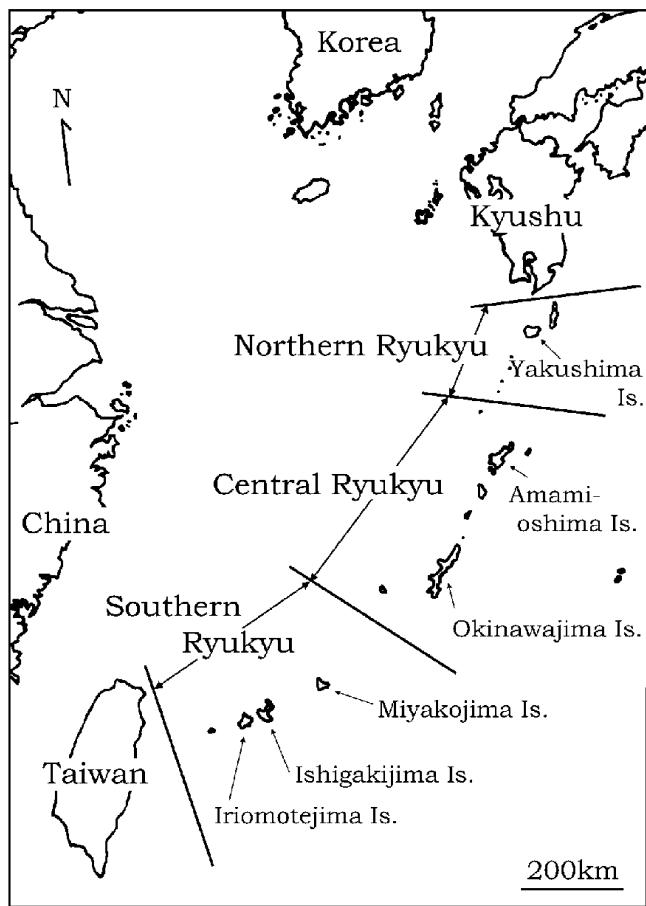


Fig. 65. Map showing the geographical localities of Northern, Central, and Southern Ryukyu.

amplified using the primer combination LCOI-1498: 5'-GGT CAA CAA ATC ATA AAG ATA TTG G-3' with HCOI-2198: 5'-TAA ACT TCA GGG TGA CCA AAA AAT CA-3' (Folmer et al. 1994). The reactants were initially denatured for 2 min at 95°C, proceeded with 40 cycles of 30 sec at 95°C, 30 sec at 47°C, 60 sec at 72°C and then the final extension at 72°C for 5 min. PCR products were purified using the ExoSAP-IT (GE Healthcare Bio-Sciences, Co. Ltd.). The purified PCR products were sequenced using the BigDye terminator cycle sequencing kit and analysed on ABI 3100 automated DNA sequencer (Applied Biosystems, Foster City, CA). Chromatograms were checked by eye. Sequence alignments were done by Clustal W program (Thompson et al. 1994) in BioEdit version 7.0.5.3 (Hall 1999).

**Data analyses.** The perl script MODELSELECT written by Akifumi Tanabe (available at <http://www.fifthdimension.jp/>) and PAUP ver. 4.0b10 (Swofford 2002) were used to determine the appropriate model of DNA evolution by AIC, AICc, and BIC for Bayesian analyses. MrBays ver. 3.1.2 (Ronquist & Hulsenbeck 2003) was employed to infer the phylogeny. Four concurrent Markov Chain Monte Carlo (MCMC) chains were run for 1,000,000 generations, saving a tree every 100 generations. Topologies prior to *In*

stabilization (“burn-in”) were discarded and posterior clade probabilities were computed from the remaining trees.

**Results and discussion.** We finally obtained 610 bp of mt-COI partial sequence from the specimens used. The best-fit model of sequence evolution determined by MODELSELECT was GTR+SS. Bayesian inference resulted in a phylogenetic tree shown in Fig. 64. The combination of species in each clade agrees with the species group recognized by morphological resemblance. *Dolomedes horishanus* is a sister to all other species comprising two reciprocally monophyletic clades. The first clade (A in Fig. 64) is uniting *D. raptor*, *yawatai*, *japonicus*, and *orion*. In the clade A, *orion* is a sister to other three species, and the resting three species seem to be an unresolved trichotomy due to the weak support ( $pp=0.52$ ). The second clade (B in Fig. 64) is uniting *D. angustivirgatus*, *sulfureus*, *fontus*, *silvicola*, and *pallitarsis*. The clade B comprises two clades (C & D in Fig. 64). The clade C is uniting *angustivirgatus*, *sulfureus* and *fontus*, and the clade D is uniting *silvicola* and *saganus*.

Although *raptor* and *japonica* in clade A are common in China, Korea and Japan main islands, *yawatai* and *orion* are endemic to Ryukyu Islands, southwest Japan. Judging from the topology of clade A and the present distribution area, we consider that the lineage leading to *orion* became isolated in Central Ryukyu (Fig. 65) from the common ancestor, and then speciation of *yawatai* occurred in Southern Ryukyu (Fig. 65). Similar phylogenetic relationships, i.e. the taxa in Southern Ryukyu are more closely related to those in Asian Continent rather than Central Ryukyu, are also known in other animals such as oriental pitvipers genus *Trimeresurus* (Tu et al. 2000), lacertid lizard genus *Takydromus* (Ota et al. 2002), or stag beetle genus *Neolucanus* (Hosoya & Araya 2006).

All of the Japanese *Dolomedes* spiders, except for *sulfureus* and *silvicola*, inhabit wetlands or streams, where they run on water surface or hide under water when disturbed. In contrast, *sulfureus* and *silvicola* are always found on vegetations and never run on water surface even when disturbed. There is a marked difference in leg length between *sulfureus*, *silvicola* and other related species, *fontus*, *angustivirgatus* and *saganus*. The legs of *sulfureus* and *silvicola* that never run on water are relatively longer than those of the other species (Figs. 40, 63). Phylogenetic analysis suggests that the characters of having long legs and inhabiting vegetations, evolved independently at two lineages leading to *sulfureus* and *silvicola*.

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**Appendix.** Collection sites and DDBJ accession numbers of *Dolomedes* spiders used for DNA analyses and *Hygropoda higenaga* as an out-group. Specimens without accession numbers has same sequence with the specimen above.

No.	Species	Sex	Collecting sites	Date	Accession No.	
1	<i>japonicus</i>	♀ (after rearing)	Nuda, Kimitsu-shi, Chiba	13-VII-2006	AB374043	
2	<i>japonicus</i>	♂ (after rearing)	Nuda, Kimitsu-shi, Chiba	13-VII-2006	—	
3	<i>japonicus</i>	juvenile	Orikisawa, Kimitsu-shi, Chiba	11-III-2007	—	
4	<i>japonicus</i>	juvenile	Orikisawa, Kimitsu-shi, Chiba	11-III-2007	—	
5	<i>raptor</i>	♀	Yakushima Is., Kagoshima	13-VII-2006	AB374044	
6	<i>raptor</i>	♀	Mona, Tateyama-shi, Chiba	21-VI-2007	AB374045	
7	<i>raptor</i>	juvenile	Mona, Tateyama-shi, Chiba	21-VI-2007	—	
8	<i>yawatai</i>	♀(after rearing)	Yonaguni-jima, Okinawa	VI-2006	AB374067	
9	<i>yawatai</i>	juvenile	Iriomotejima Is., Okinawa	5-VI-2007	—	
10	<i>yawatai</i>	juvenile	Ishigakijima Is., Okinawa	31-V-2007	—	
11	<i>yawatai</i>	juvenile	Yonagunijima Is., Okinawa	3-VI-2007	—	
12	<i>orion</i>	♂	Tokunoshima Is., Kagoshima	11-IX-2005	AB374046	
13	<i>orion</i>	♂	Nakanoshima Is., Kagoshima	5-VII-2006	AB374047	
14	<i>orion</i>	♀(after rearing)	Nakanoshima Is., Kagoshima	5-VII-2005	—	
15	<i>orion</i>	juvenile	Amami-ōshima Is., Kagoshima	98	20-III-2007	—
16	<i>orion</i>	juvenile	Amami-ōshima Is., Kagoshima	96	12-III-2007	AB374048
17	<i>orion</i>	♀	Kumajima Is., Okinawa	15-VI-2004	AB374049	
18	<i>orion</i>	♂(after rearing)	Okinawajima Is., Okinawa	VI-2004	AB374050	
19	<i>fontus</i>	♀ Holotype	Otadai, Isumi-gun, Chiba	30-IV-2004	AB374051	
20	<i>fontus</i>	♀(after rearing)	Tsutsumori, Isumi-gun, Chiba	5-V-2003	—	
21	<i>angustivirgatus</i>	juvenile	Kiwadahata, Kimitsu-shi, Chiba	11-III-2007	AB374052	
22	<i>angustivirgatus</i>	juvenile	Kiwadahata, Kimitsu-shi, Chiba	11-III-2007	AB374053	
23	<i>angustivirgatus</i>	juvenile	Kiwadahata, Kimitsu-shi, Chiba	11-III-2007	AB374054	
24	<i>angustivirgatus</i>	♀	Yokoze, Isumi-gun, Chiba	8-VI-2006	AB374055	
25	<i>sulfureus</i>	juvenile	Otadai, Isumi-gun, Chiba	11-III-2007	AB374056	
26	<i>sulfureus</i>	juvenile	Kiwadahata, Isumi-gun, Chiba	11-III-2007	—	
27	<i>sulfureus</i>	juvenile	Anesaki, Ichihara-shi, Chiba	11-III-2007	AB374057	
28	<i>saganus</i>	juvenile	Tsutsumori, Isumi-gun, Chiba	11-III-2007	AB374058	
29	<i>saganus</i>	juvenile	Tsutsumori, Isumi-gun, Chiba	11-III-2007	—	
30	<i>saganus</i>	juvenile	Tsutsumori, Isumi-gun, Chiba	11-III-2007	AB374059	
31	<i>silvicola</i>	juvenile	Orikisawa, Isumi-gun, Chiba	27-VII-2006	AB374060	
32	<i>silvicola</i>	juvenile	Nara	VIII-2006	AB374061	
33	<i>horishanus</i>	juvenile	Amami-ōshima Is., Kagoshima	4-VI-2007	AB374062	
34	<i>horishanus</i>	juvenile	Iriomotejima Is., Okinawa	6-VI-2007	AB374063	
35	<i>horishanus</i>	juvenile	Yonagunijima Is., Okinawa	2-VI-2007	AB374064	
36	<i>H. higenaga</i>	juvenile	Amami-ōshima Is., Kagoshima	4-VI-2007	AB374065	
37	<i>H. higenaga</i>	juvenile	Ishigakijima Is., Okinawa	1-VI-2007	AB374066	